

AMENDMENT UNDER 37 C.F.R. § 1.116

Application No.: 09/808,015

Atty Docket No.: Q60826

REMARKS

The Office Action of June 13, 2003 has been received and its contents carefully reconsidered.

The Examiner previously sent a copy of the Form PTO 1449 that was filed with the Information Disclosure Statement of May 15, 2001. The Examiner initialed and dated each of the references listed on that Form to indicate that he has considered and made them of record, except that the Examiner did not initial and date the *Ceramics Engineering Handbook* reference. In the Amendment Under 37 C.F.R. § 1.111 filed on May 27, 2003, applicants requested the Examiner to make this reference of record, but the Examiner has not done so and has not provided any explanation as to why this reference was not made of record. Applicants request again the Examiner to initial and date the *Ceramics Engineering Handbook* reference to indicate that he has considered it and made it of record.

Applicants note that claims 5-8 have been allowed.

Claims 2, 3 and 10 have been rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent 6,001,326 to Kim et al.

In addition, claims 2, 3 and 10 have been rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent Application Publication No. 2001/0036437 to Gutsch et al.

Applicants have cancelled claims 2 and 3, and have amended claim 10 to depend from claim 4.

Claim 4 has been separately rejected over prior art. Applicants discuss the rejections of claim 4 below.

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Claim 4 has been rejected under 35 U.S.C. § 103(a) as obvious over Kim et al '326 in view of Satoh '883.

Applicants submit that the subject matter of claim 4 as amended above is not disclosed or suggested by the cited documents and, accordingly, request withdrawal of this rejection.

Applicants have amended claim 4 to place it in independent form, and to recite that the BET specific surface area is from "about 15 to about 115 m²/g", instead of from "about 15 to about 200 m²/g". Support for this amendment can be found in Example 3, at page 17 of the present specification.

Thus, the present invention, as set forth in claim 4 as amended above, is directed to particulate titanium oxide comprising a mixed crystal titanium oxide containing rutile crystal produced by a vapor phase process, wherein the titanium oxide has a property represented by the following general formula (1)

$$R \geq 1,300xB^{-0.95} \quad (1)$$

wherein R represents a rutile content (%) measured by an X-ray diffraction method and B represents a BET specific surface area (m²/g), which ranges from about 15 to about 150 m²/g.

The particulate titanium oxide has a 90% cumulative weight particle size distribution diameter D90 measured by a laser diffraction-type particle size distribution measuring method of about 2.5 μm or less.

A characteristic feature of the present invention resides in that the mixed crystal titanium oxide containing rutile crystal is produced by a vapor phase process, so that the aggregation of the crystal titanium oxide is not significant or the particle size of the aggregated particles is small

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in comparison with that produced by a liquid phase process, while the rutile content of the mixed crystal titanium oxide is higher than that which was attained in the conventional vapor phase processes.

The Kim et al patent relates to a liquid phase process, in which it is well known that the rutile content of the mixed crystal titanium oxide can be high and the primary crystal size can be small, but the aggregation of the particles is significant so that the particle size of the aggregated particles does not satisfy formula (1) of claim 4 or the requirement that “the titanium oxide has a 90% cumulative weight particle size distribution diameter D90 measured by a laser diffraction-type particle size distribution measuring method of about 2.5 μm or less”.

Further, both Examples 1 and 2 of Kim et al disclose a specific surface area of 150 to 200 m^2/g , which is different from and does not suggest the about 15 to about 115 m^2/g BET specific surface area recited in the present claims.

In the Office Action, the Examiner refers to both Examples 1 and 2 of Kim et al.

In describing Example 2, the Examiner refers to column 8, lines 39-41 as disclosing a BET specific surface area of 150-200 m^2/g . The disclosure at column 8, lines 39-41, however, is present in Example 1, and not in Example 2.

In any event, both Examples 1 and 2 of Kim et al disclose titanium dioxide produced by a liquid phase process, not a vapor phase process. As can be seen from the Kim et al Abstract, the description at column 3, line 38 to column 4, line 15, and Examples 1 and 2 of the Kim et al patent, the Kim et al invention is based on a liquid phase process.

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Thus, Kim et al disclose a liquid phase process of producing a titanium oxide and, therefore, do not teach or suggest the present invention as defined in claim 4, which recites a particulate titanium dioxide produced by a vapor phase process and the novel titanium oxide produced by the particular vapor phase process.

The Examiner acknowledges that applicants have argued that Kim et al do not disclose a vapor phase process in Examples 1 and 2.

The Examiner asserts that this argument is not persuasive because applicants do not appear to allege any difference in the claimed product, arguing only that the process is different.

In addition, the Examiner argues that, in any case, Kim et al disclose evaporation of ethanol and water in the process which, according to the Examiner, makes the Kim et al process a vapor phase process. The Examiner particularly refers to Example 3 and claim 3 of Kim et al.

With respect to the Examiner's argument that applicants do not appear to allege any difference in the claimed product, and the fact that applicants argue only that the process is different, applicants point out that they did, in fact, argue that the difference in the processes results in a different product.

In particular, applicants argued that in a liquid phase process, the aggregation of the particles is significant so the particle size of the aggregated particles does not satisfy formula (1) or the requirement that "the titanium oxide has a 90% cumulative weight particle size distribution diameter D90 measured by a laser diffraction-type particle size distribution measuring method of about 2.5 µm or less".

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With respect to the Examiner's comment that the evaporation of ethanol and water in the Kim et al process means that the Kim et al process is a vapor phase process, applicants point out that the term "vapor phase," as used in claim 4 of the present application, indicates that the starting materials are in the vapor phase and react with each other to form titanium oxide. Thus, for example, a volatile material such as titanium tetrachloride is vaporized, and then the resulting vapor is reacted with an oxidizing gas such as oxygen and steam to obtain ultrafine particulate titanium oxide. In contrast, in a liquid phase process, a titanium-containing compound such as titanium tetrachloride or titanyl sulfate is hydrolyzed in a hydrophilic solvent. The process in Kim et al is a liquid phase process where an aqueous titanyl chloride solution is heated for a precipitation reaction. The subsequent evaporation of the water and ethanol does not convert the Kim et al process into a vapor phase process.

In addition, applicants point out that Comparative Example 1 of the present specification discloses a vapor phase process that does not result in a titanium oxide having the properties of claim 4. Comparative Example 2 discloses two commercially available titanium oxides P-25 and IT-S. Each of these products were produced by vapor phase processes, but as can be seen from Comparative Example 2, these titanium oxides do not have the properties of claim 4. Comparative Examples 1 and 2 are evidence that the properties of a titanium oxide are dependent on the method for making the titanium oxide. Therefore, the mere fact that Kim et al disclose a titanium oxide does not mean that the properties of the Kim et al titanium oxide would be the same as those recited in claim 4.

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In addition, as discussed above, Kim et al do not disclose or suggest a titanium dioxide having a BET specific surface area of 15 to 115m²/g. All of the Examples of Kim et al produce titanium dioxide having a BET specific surface area of from 150 to 200m²/g.

Further, Kim et al do not disclose or suggest a distribution constant according to Rosin Rommler formula of about 1.5 or more. The Examiner relies on Satoh et al to supply this deficiency, but applicants submit that Satoh et al do not do so.

Satoh et al do not relate to superfine particulate titanium oxide. Satoh et al disclose a solid catalyst component containing a trivalent titanium compound produced by the detailed process described in Satoh et al. Therefore, the combination of Satoh et al with Gutsch et al would not result in the superfine particulate titanium oxide of the present invention.

In view of the above, applicants submit that Kim et al and Satoh et al do not defeat the patentability of claim 4 and claim 10 which depends thereon, and, therefore, request withdrawal of this rejection.

Claim 4 has been rejected under 35 U.S.C. § 103(a) as obvious over U.S. Patent Application Publication No. 2001/0036437 A1 to Gutsch et al in view of Satoh et al.

Applicants submit that Gutsch et al '437 and Satoh et al do not disclose or render obvious the presently claimed invention and, accordingly request withdrawal of this rejection.

As discussed above, claim 4 has been placed in independent form, and has been amended to recite a BET specific surface area of about 15 to about 115m²/g.

Applicants submit that there are numerous difference between the present invention and Gutsch et al.

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The Examiner has referred to Table 2 of Gutsch et al for a disclosure of a TEM particle size of 0.2 to 2 microns. Table 2 of Gutsch et al, however, appears in Example 2, which relates to aluminum oxide and not titanium oxide. Therefore, applicants submit that it is clear that the disclosure in Table 2 of Gutsch et al does not anticipate or suggest claim 4.

The Examiner has acknowledged applicants' argument that Table 2 of Gutsch et al, which the Examiner relies on for a TEM size of 0.2 to 2 microns, relates to aluminum oxide and not titanium oxide. The Examiner responds by stating the Table is relied upon as an example of the Gutsch et al invention, which includes both Ti and Al, which, according to the Examiner, Gutsch et al disclose as being interchangeable, as disclosed at Paragraphs [0013], [0015] and [0018] of Gutsch et al.

Applicants point out, however, that although Gutsch et al disclose that various oxides can be produced by employing their process, this does not indicate that the properties of the different oxides are identical. In fact, Table 2 of Gutsch et al discloses that for aluminum oxide, different types of particles can be obtained, as shown in Tests 1 to 4, and that the TEM of these different aluminum oxides varies. The TEM which the Examiner relies on, namely, the TEM for Test 1 showing a particle size of 0.2 to 2 microns, was for a 100% amorphous product. In contrast, in Test 2, which was comprised of two different phases of aluminum oxides, the crystallites were up to four microns in size.

Claim 4 of the present application is directed to a particulate titanium oxide which contains rutile crystal and, thus, is not a 100% amorphous product. Applicants do not see how the Examiner can rely on a teaching of a particle size for a 100% amorphous product of a

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different chemical entity to assert that the titanium oxide of the present invention would be interchangeable with respect to the particle size with the aluminum oxide in Table 2 of Gutsch et al.

Further, the Examiner refers to Table 1, claim 1, and the Abstract of Gutsch et al '437 as disclosing examples of titanium dioxide having a BET surface area of 1-600 or 79 m²/g.

Table 1 of Gutsch et al '437 discloses a BET of 79 m²/g, but Table 1 relates to monoclinic ZrO₂, and not to titanium dioxide. Thus, the disclosure in Table 1 does not satisfy the recitations of the present claims.

The Abstract and claim 1 of Gutsch et al disclose a BET surface area of between 1 and 600 m²/g for oxides and/or mixed oxides, but do not specifically refer to titanium dioxide.

The Examiner acknowledges that applicants have argued that Table 1 of Gutsch et al is not directed to titanium oxide. The Examiner states that this is not a persuasive argument because Table 1 of Gutsch et al is relied upon as an example of the invention of Gutsch et al which, according to the Examiner, includes Ti and Zr, which the Examiner asserts are disclosed by Gutsch et al to be interchangeable in Paragraphs [0013], [0015], and [0018] of Gutsch et al.

The Examiner had relied on Table 1 of Gutsch et al for a disclosure of a BET surface area that satisfied the recitations of claim 2.

Applicants disagree with the Examiner's analysis that Gutsch et al disclose that titanium and zirconium are interchangeable for all purposes. In fact, Table 1 of Gutsch et al contains three Test Samples, each of which have different BET surface areas for different zirconium

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oxides. Applicants submit that it is simply incorrect to assert that a titanium dioxide would be interchangeable with a zirconium oxide with respect to the BET surface area.

Gutsch et al disclose that the BET surface area in general, is between 1 and 600 m²/g. The specific example in Gutsch et al which discloses titanium oxide, namely, Example 3, discloses a 100% rutile titanium oxide having a BET surface area of 3.1 m²/g which does not satisfy the recitations of claim 4 of the present application. There is no specific disclosure in Gutsch et al that a titanium oxide should have the particular BET surface area of claim 4 as amended above.

Accordingly, applicants submit that there is no disclosure in Gutsch et al of the recitations of the present claims.

In addition, Gutsch et al do not disclose the particular vapor phase process of the present invention and, therefore, do not disclose the novel titanium oxide obtainable by the particular vapor phase process.

The Examiner has acknowledged that applicants have argued that Gutsch et al do not disclose the particular vapor phase process Gutsch et al employ.

The Examiner states that this is not persuasive because applicants do not appear to allege any difference in the claimed product, arguing only that the process is different.

With respect to the Examiner's argument that applicants do not allege any difference in the claimed product of the present claims and Gutsch et al, and that applicants only argue that the process is different, applicants point out that in the previous Amendment under 37 C.F.R. § 1.111, filed on May 27, 2003, applicants argued generally that Gutsch et al do not disclose the

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particular vapor phase process of the present invention and, therefore, do not disclose the novel titanium oxide obtainable by the particular vapor process. Further, as can be seen from the above discussion, applicants have argued and do argue that Gutsch et al do not disclose or suggest the particle size and BET specific surface area of claim 4.

In addition, the Examiner argues that in any case, Kim et al disclose evaporation of ethanol and water in the process, which is a vapor phase process, as disclosed in Example 3 and claim 3 of Kim et al. As discussed above in connection with the rejection of claim 4 based on Kim et al, Kim et al do not disclose a vapor phase process, and not all vapor phase processes result in the titanium oxide of the present invention.

Further, Gutsch et al do not disclose or suggest a distribution constant according to Rosin Rommller formula of about 1.5 or more. The Examiner relies on Satoh et al to supply this deficiency, but applicants submit that Satoh et al do not do so.

Satoh et al do not relate to superfine particulate titanium oxide. Satoh et al disclose a solid catalyst component containing a trivalent titanium compound produced by the detailed process described in Satoh et al. Therefore, the combination of Satoh et al with Gutsch et al would not result in the superfine particulate titanium oxide of the present invention.

In view of the above, applicants submit that Gutsch et al and Satoh et al do not defeat the patentability of the presently claimed invention and, accordingly, request withdrawal of this rejection.

Claims 9 and 11 have been rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Iglesia et al '801.

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In addition, claims 9 and 11 have been rejected under 35 U.S.C. § 102(e) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Kim et al '326.

Further, claims 9 and 11 have been rejected under 35 U.S.C. § 102(e) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Gutsch et al '437.

Applicants have cancelled claims 9 and 11. Accordingly, each of these rejections is moot.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,


Sheldon I. Landsman
Registration No. 25,430

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
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CUSTOMER NUMBER

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